



The Open
University

M140

Introducing statistics

M140 Guide





The Open
University

M140

Introducing statistics

M140 Guide

Cover image: Minxlj/www.flickr.com/photos/minxlj/422472167/. This file is licensed under the Creative Commons Attribution-Non commercial-No Derivatives Licence
<http://creativecommons.org/licenses/by-nc-nd/3.0/>

This publication forms part of an Open University module. Details of this and other Open University modules can be obtained from the Student Registration and Enquiry Service, The Open University, PO Box 197, Milton Keynes MK7 6BJ, United Kingdom (tel. +44 (0)845 300 6090; email general-enquiries@open.ac.uk).

Alternatively, you may visit the Open University website at www.open.ac.uk where you can learn more about the wide range of modules and packs offered at all levels by The Open University.

To purchase a selection of Open University materials visit www.ouw.co.uk, or contact Open University Worldwide, Walton Hall, Milton Keynes MK7 6AA, United Kingdom for a brochure (tel. +44 (0)1908 858779; fax +44 (0)1908 858787; email ouw-customer-services@open.ac.uk).

The Open University, Walton Hall, Milton Keynes, MK7 6AA.

First published 2013. Second edition 2014.

Copyright © 2013, 2014 The Open University

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, transmitted or utilised in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, without written permission from the publisher or a licence from the Copyright Licensing Agency Ltd. Details of such licences (for reprographic reproduction) may be obtained from the Copyright Licensing Agency Ltd, Saffron House, 6–10 Kirby Street, London EC1N 8TS (website www.cla.co.uk).

Open University materials may also be made available in electronic formats for use by students of the University. All rights, including copyright and related rights and database rights, in electronic materials and their contents are owned by or licensed to The Open University, or otherwise used by The Open University as permitted by applicable law.

In using electronic materials and their contents you agree that your use will be solely for the purposes of following an Open University course of study or otherwise as licensed by The Open University or its assigns.

Except as permitted above you undertake not to copy, store in any medium (including electronic storage or use in a website), distribute, transmit or retransmit, broadcast, modify or show in public such electronic materials in whole or in part without the prior written consent of The Open University or in accordance with the Copyright, Designs and Patents Act 1988.

Edited, designed and typeset by The Open University, using the Open University TeX System.

Printed in the United Kingdom by Page Bros, Norwich.



SUP 04254 4

Contents

Introduction	5
1 Study Guide	6
1.1 What is M140 about?	6
1.2 What to do first	7
1.3 Assessment	12
1.4 How to study	17
1.5 Learning outcomes	20
1.6 Support and how to contact the OU	22
2 Technology Guide	24
2.1 Computing safely	24
2.2 Minitab, the statistical software package	25
2.3 Interactive computer resources	25
2.4 Screencasts	25
2.5 Practice quizzes, iCMAs and iCME	26
2.6 Forums	27
2.7 Online tutorials	29
2.8 Computing support	30

Introduction

Welcome to M140 *Introducing statistics*. We hope that you will find studying this module an enjoyable and rewarding experience.

The Introduction and Section 1 of this M140 Guide contain important information about M140. This includes what you need to do to prepare yourself for M140, and how the module is assessed, including details of the end-of-module assessment.

Please read the Introduction and Section 1 *before* you start working on the study units.

You can then start studying Unit 1, which you should do as soon as you can.

The two main sections of this M140 Guide are described below.

- **Section 1: Study guide**

This tells you about the structure of M140, what you need to do whilst you are studying it, how you will be assessed, and the support that you can expect to receive. You should read this as soon as possible because there are various activities that you will need to undertake to ensure that you are ready to begin working on the study units.

- **Section 2: Technology guide**

This gives further details about the computing and online components of M140. You may wish to skim through this now, and read it in more detail as and when you need to during your studies.

In addition, you have been sent an **M140 Accessibility Guide**. This is primarily aimed at those who may have difficulty studying one or more elements of M140, perhaps because of a disability. If you envisage that you may have such difficulty, please read the Accessibility Guide.

As well as the study texts that you received with this M140 Guide, other essential learning resources will be delivered through the M140 website. This can be accessed from your StudentHome page and will open about two weeks before the official start date of M140. Any significant updates to the information in this M140 Guide, and other study texts, will be provided on the website. The M140 website and StudentHome are described in more detail in Subsection 1.2, under 'Access StudentHome and the M140 website'.

Keep this M140 Guide to hand while you study, as you will need to refer to it throughout your studies.

1 Study Guide

This section tells you more about M140 and how you will be studying it. It also describes what you need to do before starting your study of the module books.

1.1 What is M140 about?

M140 *Introducing statistics* is about using data, usually in the form of numbers, to describe aspects of society and the environment so that we can understand, interpret and, on occasion, change the world around us. Statistics is a broad discipline, touching virtually all aspects of social and scientific activity. This module gives many examples of the way statistical thinking can be used to help in important aspects of our lives.

In addition, M140 provides an introduction and underpinning, not only to the study of further modules in statistics, but also to other subjects that can involve statistical ideas, such as economics, business, engineering, and natural and social sciences.

M140 is based around twelve study units which are sent to you in five printed books. The units are also available in electronic formats on the M140 website. The book and unit titles are listed below.

Book 1 Descriptive statistics

- Unit 1 Looking for patterns
- Unit 2 Prices
- Unit 3 Earnings

Book 2 Regression and surveys

- Unit 4 Surveys
- Unit 5 Relationships

Book 3 Hypothesis testing

- Unit 6 Truancy
- Unit 7 Factors affecting reading

Book 4 Association and estimation

- Unit 8 Teaching how to read
- Unit 9 Comparing schools

Book 5 Experiments and clinical trials

- Unit 10 Experiments
- Unit 11 Testing new drugs
- Unit 12 Review

Accompanying the study units, there is a Computer Book and Handbook.

There are also several online resources to help support your study, including screencasts (short audio-visual presentations), practice quizzes and interactive computer resources.

1.2 What to do first

Each of the following subsections lists activities that you should do before you begin your study of Unit 1. You should do these as soon as possible so that you are ready to begin working on Unit 1 no later than the date given on the study planner of the M140 website (described below). Depending on your previous background in mathematics and statistics, and as an Open University (OU) student, you may need to allow several hours to complete these activities. Some of these activities can only be done once the M140 website has opened, so you may need to leave those until then. You might like to tick off the activities as you complete them.

Check the materials

You may be wondering where to start with all the materials that have arrived from the OU.

It is vital that you check the content of the mailing as soon as possible, so that you know what it contains and so you can make sure that all the items are present. Find the Contents Checklist and tick off each item listed as you unpack it. If anything is missing, follow the instructions on the Contents Checklist to notify the OU, so that replacements can be sent to you.

Organise your study area

Ideally, you will study in a place that is away from distractions, close to where you can store all the materials and by the computer that you will be using for M140.

You are likely to need the following items each time you are studying M140.

- The relevant M140 text.
- Easy access to a computer with connection to the internet. There are more details on the computer requirements in 'Check your computer' below.
- Paper, pens, pencils, eraser and a ruler.
- The M140 Handbook, which contains some of the key ideas and formulas taught in M140.
- The M140 Computer Book, which will guide you through using the module software and how to use the interactive computer resources to reinforce your understanding of important concepts from the units.
- This M140 Guide.
- A basic scientific calculator. Details of suitable calculators are given in 'Check your calculator' below.

Organise your time

Studying takes time, effort and organisation; distance learning also demands a great deal of self-discipline. To prepare for a period of concentrated study, you need to have everything ready before you start, and have a clear picture of what you are going to do and when.

You will need to decide when you will study and how you will find time each week to stay on schedule. An average student is likely to need about 16–20 hours to study each M140 unit, but some topics may take some people longer. If M140 is the only module you are studying, you will have approximately two weeks to study each unit. Otherwise, the number of days or weeks over which you can spread the study hours will depend on how many other modules you are studying. You will also need to allow time for the assignment questions, and for other activities such as tutorials.

You will need to identify times during the week when you can study, and times when you cannot study, due to other commitments. You may even have to reduce some of your regular commitments to make time for study. If you have not studied for a while, you may find it more beneficial to plan several short study sessions, rather than a few long ones, until you get into the study habit. For the majority of M140, you will need to work in periods of at least 1–2 hours at a time.

Being self-disciplined about the use of time is the key to developing good study habits and not getting overwhelmed by the different tasks and assignment deadlines.

The weeks during which you should be studying each unit are given in the study planner on the M140 website. The study planner also includes other key dates, such as the dates by which your assignments must be received (known as **cut-off dates**) and the dates of tutorials.

It's important to keep up with the schedule in the study planner as much as possible, or you could find that you've run out of time to study the units needed to complete an assignment before it has to be submitted. Many students find it helpful to work slightly in advance of the study planner, in case anything unexpected happens which might disrupt their plans.

You can print the study planner, using the link below it on the M140 website, and keep it handy (perhaps at the front of the folder where you keep your M140 work, or pinned up somewhere so that you can see it every day).

Once you have access to the appropriate study planner, you should use it to start planning your studies over the next few months.

So try to plan your study times, fitting them in with your other commitments, to make sure that you don't fall behind.

Most units have a description in their introductions briefly saying what is in each section of the unit, and drawing attention to sections that might take longer than average to work through. You can take this into account when planning your study of the unit.

Check your calculator

Check that you have a working scientific calculator. You will need this for some of the activities and assignments in the module.

A scientific calculator is one with the basic addition, subtraction, multiplication and division keys, plus operations such as square roots (usually denoted by a key with a $\sqrt{\quad}$ on it), and which performs calculations in the mathematically correct order. For example, if you key in $3 + 2 \times 4$, your calculator should give the answer 11. If your calculator gives the (incorrect) answer 20, then you may have difficulty using it for M140.

Such calculators also usually perform mathematical operations such as cos, tan, log, which will not be needed for M140. However, if you have studied other mathematical modules, or plan to do so in the future, you may need features like these for those modules.

There is a vast range of suitable calculators available, and you may have one from a previous course of study or from school. While any scientific calculator can be used for M140, we recommend the use of a modern calculator which incorporates features that make it easier to use. These features include the following:

- Two lines of display, so that the input and the answer can be viewed at the same time.
- Calculations are entered as they are written. For example, to calculate $\sqrt{30}$, the $\sqrt{\quad}$ key is entered, followed by 30. (On older calculators, the $\sqrt{\quad}$ key would need to be entered *after* 30.)

Some scientific calculators have facilities that make some statistical calculations, such as finding a mean or standard deviation, easier. While you might well find such facilities useful for M140, it is *not* essential to have such a calculator for your M140 studies. Most statistical calculations that involve more than a few numbers will be done using computer software. Having a calculator with statistical functions will certainly do no harm on M140, but you will have to work out for yourself how to use it – it is not practical to give generic instructions for how to use a calculator with statistical functions, because they vary considerably from one calculator to the next.

However, an important point is that there are some very complicated and expensive calculators on the market, which provide facilities that you will *not* need for M140. If you already have such a calculator, it should be fine to use it for M140. But you should think very carefully if you are considering *buying* an expensive calculator for M140 and your later OU studies. The extra facilities are unlikely to help your M140 studies. On future modules that you might take, with an examination, there may be specific rules about what calculators can be used in the exam, and in some cases, more complicated calculators (e.g. programmable ones) are not allowed.

Check your computer

Check that you have access to a personal computer of the required specification, as detailed in the M140 description at www3.open.ac.uk/study/undergraduate/course/m140.htm.

You should also have a basic knowledge of how to use a computer. In particular, we assume that you:

- can navigate around a standard desktop on a computer
- can use the mouse or keyboard to open a document, folder or program
- can create new folders and documents
- have access to an internet service provider (ISP) and have familiarised yourself with connecting your computer to the internet and using a web browser
- are using the most up-to-date version of your chosen web browser
- are using the most up-to-date version of your chosen PDF reader (e.g. Adobe Reader).

The OU Computing Guide, available from StudentHome, contains some useful information that may help you to use your computer as part of your studies. It includes information on accessibility, using a computer, computing equipment, safe computing, internet access and what OU resources are available to you. The OU Computing Guide also includes details of the computing codes of conduct.

Some further details of how you will use your computer in M140 are given in Section 2, the ‘Technology guide’.

Check your mathematical skills

The M140 learning materials do assume that you have some mathematical skills. If you have previously successfully studied Y033 *Science, technology and maths Access module* or its predecessor module Y182 *Starting with maths*, and/or MU123 *Discovering mathematics*, you should possess the necessary skills. If you haven’t, or if you want to brush up your knowledge, you could work through the materials at Maths Help (<http://mathshelp.open.ac.uk>), which will help you to refresh your knowledge of the topics that you should ideally be confident with *before* embarking on M140. If you find that a lot of the mathematical skills on Maths Help are difficult or new to you, it would be sensible for you to contact your Learner Support Team – see your StudentHome page for details.

Maths Help has short modules covering the following topics:

- numbers, units and arithmetic
- rounding and estimation
- ratio, proportion and percentages
- squares, roots and powers
- diagrams, charts and graphs
- language, notation and formulas
- geometry (*not necessary for M140 study*)
- using a scientific calculator. (*The Maths Help module for this topic may be helpful if you have a Casio fx-83 ES scientific calculator (or a compatible model), but only the first few sections of the module are relevant to M140.*)

Access StudentHome and the M140 website

To access your StudentHome page, you will need your OU computer username (OUCU) and password. (These are given in the information that you received when you first registered with the OU.)

Your StudentHome page is specifically tailored to your own needs and interests and can be used to reach all the OU's student resources.

Follow the various links provided on your StudentHome page and make sure that you can find the following.

- Your study record for M140 (and any other current modules).
- Your M140 tutor's details (these will appear about a week before the official start date).
- The OU's extensive range of study support resources (e.g. time management skills, the OU Computing Guide) to refer to if you need them.
- The M140 website (note that this may not be open until about two weeks before M140 is due to start).

From the M140 website, you will be able to access all the resources associated with each unit. The easiest way to do this is to click on the relevant link within the study planner, where the study material is scheduled for each week. You will see other resources on the website, including the 'Assessment resources', where your M140 assignments will be available. You will also be able to access forums for M140, where you can have online discussions with other M140 students. Further details of the forums are in Subsection 2.6.

When moving through the resources contained on the M140 website, you can always return to the main page by clicking the M140-xxx link above the left-hand column of the page. (Here xxx will be a three-letter code representing the year and month in which you start your M140 studies.)

You should visit the M140 website at least twice a week to check for the latest news and information. Any updates to the module materials will also be posted here.

Contact your tutor

We encourage you to establish contact with your M140 tutor as soon as his or her details appear on your StudentHome page, by sending an email or making a telephone call. Your tutor will be delighted to hear from you.

You are one of about twenty students allocated to a tutor (also known as an associate lecturer (AL)) for M140. Your tutor will support your learning throughout your M140 studies and you can contact him or her by telephone, post or email. Your tutor will mark your written assignments, and provide comments and feedback to help you to improve your understanding. Most tutors will also provide tutorial support for their group of students: this may be delivered face-to-face or online, or a mixture of the two. Further details of tutorials are given in Subsection 1.6 under 'Support from your tutor'. OU tutors are extremely dedicated people who want to help you with your studies, so don't hesitate to contact your tutor for help or advice.

Your tutor will tell you when and how it is best to contact them. Some tutors will give preferred times to be called by phone; others may be happy for you to call at any time and to leave a message if they are unavailable. Tutors will probably check their OU email a few times in most weeks. Please have reasonable expectations of your tutor: they want to help you, but they often work for the OU for only a small proportion of their time.

1.3 Assessment

There are three types of assessment that count towards your module result for M140: tutor-marked assignments (TMAs), interactive computer-marked assignments (iCMAs) and the end-of-module assessment (which itself consists of an interactive computer-marked part and a written part marked by a tutor). Details of each of these elements are given below, followed by details of how your overall module result will be calculated.

The TMAs and iCMAs are provided on the M140 website.

They will be made available at various points during your studies – they will not all be on the website at the beginning of M140. The dates by which you must submit these assignments, known as cut-off dates, are given in the M140 study planner. These dates are important, so it would be sensible to note them now.

If you encounter any difficulties in completing assignments, then contact your tutor as early as possible for advice.

All details of the University's assessment policies are given in the Assessment Handbook, available from your StudentHome page.

Tutor-marked assignments

There are four written assignments (called tutor-marked assignments or TMAs), that you send to your tutor (not directly to the University) to be marked. Your tutor will contact you towards the start of the module to give you the address to which you should post your TMAs.

Each TMA relates to several study units, as indicated in Table 1. Apart from Unit 12, every unit is assessed in a TMA.

Table 1 Tutor-marked assignments (TMAs)

TMA	Units covered
TMA 01	1, 2
TMA 02	3, 4, 5
TMA 03	6, 7, 8, 9
TMA 04	10, 11

The tutor-marked assignments will be available to download from the M140 website, in the 'Assessment resources' area. You are advised to print out each TMA.

The cut-off date for a TMA is the last date on which your tutor may accept your work for marking, unless he or she feels that there are exceptional reasons why you should be allowed to submit late. If you are concerned about meeting a deadline, then you should contact your tutor well before the cut-off date.

Interactive computer-marked assignments

There are three interactive computer-marked assignments (iCMAs). These online assessments are similar to the practice quizzes that are linked to each unit – except that they count towards your module result. By a standard OU convention, these iCMAs are numbered starting at 41.

It is strongly recommended that you work through the practice quiz for each unit, so that you are well prepared for the related assessment questions, and that you work on the relevant questions in each iCMA as soon as you have finished studying the associated unit.

Like the TMAs, the iCMAs relate to several study units, as indicated in Table 2. Not every unit is assessed by an iCMA.

Table 2 Interactive computer-marked assignments (iCMAs)

iCMA	Units covered
iCMA 41	1, 2, 3
iCMA 42	6, 7
iCMA 43	12, and revision

The iCMAs will be available from the M140 website and **must be completed online**. Read the instructions at the start of each iCMA before commencing work on it. Before starting an iCMA you will be required to confirm that your work is all your own.

Each iCMA is available for you to work on for several weeks, and you can spend as long as you wish on the questions within that time, and change your answers as many times as you like until you 'submit and finish' the iCMA. **Since the score for your iCMAs counts towards your overall continuous assessment score for M140, each iCMA can only be submitted for marking once, by clicking the 'Submit all and finish' button.** You will not receive any feedback on your assessment until after the cut-off date. You are strongly advised to attempt all of the questions. Try to resist the temptation to guess the answers to questions, unless you are very short of time.

You will not be able to see your score as soon as you submit an iCMA. The score for each iCMA will be displayed on your StudentHome page soon after the cut-off date for that iCMA. You may then revisit the iCMA to look at the feedback on your answers.

You will not be given exactly the same questions as other students, but all students will be given questions of the same level of difficulty. As with practice quizzes, it is possible for your tutor to see your marks, the questions you were asked and the responses you gave, although there is no expectation they will do so. If you wish to query a point with your tutor, you should note the details of the question you were asked.

You must submit each iCMA no later than 23:59 UK local time (just before midnight) on its cut-off date, whether or not you have fully completed it. **No late submissions are permitted for iCMAs.**

Some further information on iCMAs is provided in Subsection 2.5.

End-of-module assessment

At the end of the module, there is assessment which relates to the whole module, and which plays a different role in determining your module result from that of the TMAs and iCMAs that have just been described.

This end-of-module assessment consists of two parts. There is a computer-marked part, or final iCME, which works in the same way as iCMAs 41 to 43 described above, although your score will not be given until later. There is also a written end-of-module assessment ('written EMA'), which you will answer in a similar way to the TMAs. It will be marked by an M140 tutor, but not by your own tutor. Instructions for how to submit this written EMA for marking will be given to you nearer the end of the module.

It is important to understand that no late submissions of either part of the end-of-module assessment will be allowed.

If there is a good reason why you will not be able to do the final iCME, for example, if you have a disability that physically prevents you using a computer for this kind of task, then you must follow the instructions that will be given on the module website nearer the end of the module.

Your module result

Your module result for M140 is calculated from two scores:

- The **overall continuous assessment score (OCAS)**, which is the score in the 'continuous assessment component' of the module, that is, the four TMAs and the three iCMAs. This is calculated by weighting the individual assessment scores as shown in Table 3. Note that the iCMAs have considerably lower weights than the TMAs, and that TMA 03 has twice the weight of each of the other three TMAs.
- The **overall examinable component score (OES)**, which is the score you receive from the two parts of the end-of-module assessment. (It is called an 'examinable component' score despite the fact there is no examination as such.) This is calculated by weighting the scores of the two parts of the end-of-module assessment as given in Table 4.

Table 3 Overall continuous assessment score (OCAS)

Assignment	OCAS Weighting
TMA 01	15.5%
TMA 02	15.5%
TMA 03	31.0%
TMA 04	15.5%
iCMA 41	7.5%
iCMA 42	7.5%
iCMA 43	7.5%

Table 4 Overall examinable component score (OES)

Assignment	OES Weighting
Final iCME	30%
Written EMA	70%

To pass M140 you must

- achieve an OCAS of at least 40%
- achieve an OES of at least 40% and in addition score at least 30% on the written EMA.

If you get high scores for both the OES and the OCAS, you may be awarded a Distinction.

Substitution of assignment scores

Note that if your score on any of TMA 01, or TMA 02, or iCMAs 41–43 taken together, is less than the OCAS score, then one of those scores will be substituted as explained in the Assessment Handbook (available from your assessment record on the M140 website) and your OCAS will be recalculated. This happens automatically – you do not have to ask for it to happen.

If you miss a TMA or an iCMA, then you will receive no marks for it (but this might be partially compensated for by substitution). Missing one of the TMAs or iCMAs does not mean that you will fail the module, though it will mean that your OCAS is lower. But do get in touch with your tutor if you are having study difficulties that might cause you to miss an assignment.

Most students who get as far as the end-of-module assessments will pass M140. In order to achieve a pass, you need to gain an overall OES of 40% from the written EMA and final iCME, and in addition reach the 30% threshold on the written EMA. If you do not meet one or both of these criteria but your OCAS is at least 40%, then you will be offered the chance to ‘resubmit’. This means that you get another chance to submit the two parts of the end-of-module assessment, and (if your scores for them are good enough) you can pass M140 without having to redo the TMAs or the iCMAs. **Eligibility for a resubmission is lost if you do not submit both the written EMA and the iCME.**

If you do not submit the written EMA, then you will fail the module (as you cannot reach the 30% threshold). In addition you will *not* be allowed to ‘resubmit’, however good your other scores are, and if you want to pass M140 you will need to go through the whole module again, submitting all the assessments again.

Thus it is *particularly* important that you submit the written EMA. If you have a good reason why you will not be able to submit the written EMA or the iCME – for example, because of a period of extended serious illness – you must follow the instructions in your Assessment Handbook.

Your assessment record

Your assessment record on the M140 website lists your results on the module assessments to date. There is an Assessment Calculator available on the Assessment resources page of the M140 website to help you to see how you are progressing with your assessment scores and the effect of any substitution.

Your own work

The purpose of assignments is to assess your understanding, and this can only be done if it is your own work and you use your own words. For this reason, copying someone else's work without making reference to the author is regarded as cheating.

It is therefore very important that you write your assignments in your own words. Copying or closely paraphrasing passages from other sources of material is called *plagiarism*. It is, however, to be expected that the layout and your mathematical workings will be similar in format to those in the study units, and these will provide a guide as to how much detail you should give in your solutions.

Further advice can be found on the M140 website.

It is *essential* that you do not post any assignment questions or your answers to them on any internet sites or online networks (and this includes advertising them for sale), as this would be considered to be a breach of copyright and/or promoting plagiarism.

Special circumstances

If at any stage you are having difficulty in completing an assignment, then you should first contact your tutor to discuss what might be best to do.

However, if circumstances arise that prevent you submitting a TMA or iCMA at all, or result in you having to submit an assignment that is incomplete or otherwise well below your usual standard, then you should consider reporting the circumstances to the University so that the M140 Examination and Assessment Board can bear them in mind as it determines your overall result.

Details concerning the submission of special circumstances information are given in the Assessment Handbook (available via your StudentHome page).

1.4 How to study

In this subsection we give some suggestions of ways of studying that may help you in M140. Different people have different approaches to study, and what works best for you may be different to the suggestions here.

How to read a unit

You will gain most benefit from your study if you read the units with a pencil and paper to hand, annotating them and making your own notes as you go.

The secret of good note-taking is to achieve a sensible balance between length and detail so that only the important results, and not too much unimportant detail, are included. It is sometimes not so easy, especially when beginning your studies, to decide what is or isn't important and where to place the emphasis. Most people will want to include new definitions, and practise using new symbols and notation. Ways in which you might record your notes include lists, worked examples and diagrams to illustrate ideas and other associated knowledge. If you think that your notes could be improved, perhaps you should consider including less material, using larger paper or using more colours. If you are annotating your texts, are you picking out too much or too little? Again, would more colours help?

You should also write out your solutions to the activities within the units and perhaps annotate them with brief notes about anything that you first got wrong but then corrected, or found difficult but then resolved. Writing out your solutions will give you useful practice in writing mathematics and statistics, and you can refer to them when you do assignment questions and prepare for the end-of-module assessment.

Try to keep your solutions to activities and other notes you make in an organised way, for example in a ring binder or notebook. You can then find them easily to refer to later.

How to approach a statistical question

Throughout M140 you will need to answer statistical questions, both as part of activities in the study units and within the module assessment. Here are some suggestions of how to approach this.

When you are faced with a written question or problem to solve, you should make sure that you read it carefully. It is important that you get to grips with it in two ways: absorb the information given, and find out what the question is really asking. Your solution will link the two. This method can be summarised by the following questions.

- What do I know?
- What do I want?

Try to decide not only what you know from the question itself, but also what you know from past experience which is relevant to the problem.

Many statistical questions require you to link statistical and mathematical thinking to what is going on in the world. So it is important to be sure you understand what the question is asking about the real world.

Make sure you read the question carefully, noting exactly what is required. You may find it helpful to underline or highlight some parts. If you get stuck, look again at the information given in the question and consider what previous knowledge you need to apply. Try to write out your thinking as clearly as possible, so that you can easily see each step and the ideas on which each is based, and consider whether any answers you have come up with make sense.

You may find that you need to leave the question for a while and then come back to it, in order to see things more clearly. In this case, it is vital that you have written down what you have done so far. If you cannot make any progress with a problem, it is a good idea to talk to someone about it, even if the person you talk to does not know much about statistics. The act of describing a problem to someone can often be enough to help you see what you should do to arrive at a solution.

When you have found a solution, you should check your answer against what you know, to be sure that it makes sense in the context of the original question – and if the question is asking you to relate what you did to the real world, check that your answer makes sense in that way.

When you write out your solutions to TMA questions, remember that you are writing to communicate with your tutor. Ensure that what you write consists of sentences. Your solution may contain mathematical material, and many people believe that mathematics is a language which is entirely made up of (often unfamiliar) symbols; it is not, many symbols act merely as abbreviations which, when read, can be translated back into spoken words. Remember, too, to punctuate your work. Ensure that there are sufficient words of explanation so that the reader is led line by line through your proposed solution or argument. Include diagrams where appropriate.

If the question requires you to include computer output from Minitab, make sure that you include the relevant parts of the output, but don't just include *all* the output you produced, as some of it may not be relevant. Write a sentence or two to explain what the output is and why it is there. If you are drawing conclusions from the output, be sure to say explicitly what they are.

Generally, you should state your results and conclusions explicitly. Do not expect your tutor to have to search for an answer.

Check what the question says about the level of accuracy required, and ensure your answer matches this.

What to do when you are stuck

Getting stuck on a particular statistical point is inevitable – it happens to us all. You might get stuck when trying to understand a section of a study unit, or when attempting to answer a question for an activity or an assignment. It's often worth spending a few minutes trying to resolve it yourself; if you can, then you're likely to learn from the process, and you should remember what you've learned more easily in future. It may help to look back at the material that led up to that point, and make sure that you fully understand it. If there is a screencast related to what you are doing, you may find this useful. But you shouldn't spend a large amount of time puzzling over a particular point without making progress. Sometimes it can help to take a short break, and come back to the problem refreshed. Many difficulties can be resolved rapidly with help from your tutor or other students, as described in Subsection 1.6, leaving you more time to get on with the rest of the unit or TMA.

1.5 Learning outcomes

All OU modules have a set of learning outcomes that are statements of what a student is expected to know, understand and be able to do at the end of the module. Learning statistics is not just about knowing subject-specific details but also about developing the skills necessary to use this subject knowledge.

You will see that the learning outcomes are of four types:

- knowledge and understanding related to the content and subject matter of the module
- cognitive or thinking skills associated with analysis and synthesis of the content
- key skills that are more general and include the ability to communicate and to use relevant ICT (information and communication technologies) and information literacy and mathematical skills
- practical skills related to the subject area.

The list of learning outcomes that follows is a summary of what you should know, understand and be able to do once you have completed M140. The study units and computer-based resources provide opportunities for you to develop and demonstrate these learning outcomes. Such a list may appear rather daunting when you begin your M140 studies. However, you shouldn't be too concerned – a more detailed list of learning outcomes is given at the end of each unit, and this will be more closely related to what you should understand from the unit.

Learning outcomes for M140

Knowledge and understanding

- Demonstrate knowledge and understanding of some key ideas on statistics.
- Demonstrate knowledge and understanding of basic statistical vocabulary and notation introduced and developed in the study units.
- Demonstrate knowledge and understanding of a repertoire of statistical techniques for analysing data.

Cognitive skills

- Select and use appropriate techniques and strategies for analysing data in a range of everyday contexts.
- Interpret statistics in real-life situations, providing answers in a non-technical format.
- Develop simple statistical arguments.

Key skills

- Explain statistical ideas from the study units in writing, using appropriate terminology, notation and style.
- Develop skills in learning independently – manage study times, learn actively, reflect on progress and plan further learning.
- Use ICT tools such as the electronic assessment system and online resources for learning.

Practical skills

- Describe questions about data statistically.
- Use a computer to analyse data.
- Analyse and comment on statistical analyses.

1.6 Support and how to contact the OU

You are not alone when studying M140. Support is available from your tutor and other students, through face-to-face or online tutorials, and via the M140 website, as explained in the following subsections.

If you experience difficulties that are not directly related to the content of M140, you should contact your Learner Support Team – see your StudentHome page for details.

Support from other students

You will have access to online forums where you can discuss M140 with other students. These online forums are an ideal way for students to help each other by asking questions, or by providing study tips. Trying to explain an idea to someone is often an excellent way of improving your own learning. You should also find it interesting and reassuring just to see how other students are getting on with the module.

The forums can be used to discuss all aspects of M140 and of statistics in general, but should not be used to discuss answers to specific iCMA or TMA questions.

We recommend that you check that you can access the M140 forums before you begin your studies (via the link on the M140 website). It should be 'open' to begin discussions about a week before the official start date.

The forums are primarily provided to facilitate mutual support between students. They will be monitored by M140 tutors, who will intervene if incorrect or inappropriate information is being posted to a forum, but will not respond to every posting. The OU has a responsibility to maintain an educational environment where all students feel that they can participate without fear of being ridiculed, abused or upset. All students are expected to communicate in a reasonable manner and to help maintain a friendly, supportive environment, and to abide by the OU computing code of conduct (available via the OU Computing Guide). On the rare occasions that a person's behaviour becomes unacceptable, the University has the right to exclude that person from the University network.

Information on how to access and use the online forums is given in Subsection 2.6.

Support from your tutor

Your tutor is there to help you with any problems related to M140 that you encounter, and he or she can also provide advice on other matters related to your progress, such as what you should do if you're worried about completing a part of the module in time. Your tutor will also help you by making comments on your TMAs. These comments should point out what you have done well, while indicating any misunderstandings and errors.

Many M140 tutors offer a programme of tutorials that are designed to help your study of the module. Some tutorials may be face-to-face meetings, others may take place online. If your tutor is offering tutorials, the dates will be given on the study planner. You are also welcome to attend tutorials given by other M140 tutors, should they be more convenient for you. You can find details of these by using the online Tutorial Finder (accessible from StudentHome), or by contacting your Learner Support Team. It is always worth double-checking the online Tutorial Finder the day before a tutorial in case of any changes.

Tutorials are also an opportunity to meet other students on the module.

Support from the OU Library

As a registered student, you can access the wide range of online resources provided through the OU Library's subscriptions. See the 'Library resources' page on the module website for links and some suggested resources. If you need help with any resources, then you can contact the Library Helpdesk by phone, email or webchat. Contact details are on the Library website.

Queries and how to contact the OU

The best way to contact the OU for most sources of help is via StudentHome. Alternatively, you can use the Student Registration and Enquiry Service number at any time: +44 (0) 845 300 6090.

In all contact with the University, you should give your name and student number (personal identifier, or PI) so that we have a record of your request and can contact you. In any emails that you send via StudentHome, your name and PI will be completed automatically. If your query is specifically about M140, please note the contact details given below.

- For clarification and/or help on any of the M140 materials, or queries about assignments, contact your tutor in the first instance, or the M140 forums.
- For queries that cannot be answered by your tutor, contact the M140 team.
 - Email: MCT-Maths-Stats-Programme@open.ac.uk
 - Phone: +44 (0) 1908 332555.
- For comments on M140 itself (e.g. suspected errors), contact the M140 team as above.
- If you have problems with how to use Minitab for the activities in M140, contact your tutor in the first instance, or the M140 forums.
- If you have other problems using your computer for OU study or with OU online services, including technical problems with installing Minitab, contact the OU Computing Helpdesk, as described in Subsection 2.8.

2 Technology Guide

This section explains the computing and online components of M140. These include the use of the statistical software package Minitab, the screencasts and the interactive computer resources that you will need to use as you study, the interactive computer-marked assignments (iCMAs) that form part of the assessment of M140, the practice quizzes designed to enable you to practise and revise the statistics you are studying, and details of various computer-based tools that you may use to communicate with your tutor and other students on M140.

It is suggested that you skim through this section before commencing your studies, and then refer back to it as you need to. Any updates to the information given here will be made available via the M140 website.

2.1 Computing safely

If you are going to use a computer often, it is worthwhile spending some time ensuring that you have a comfortable working position to avoid any wrist, back and eye problems. Information on how you can set up your computer working area and some guidance on good working practice is given in the online OU Computing Guide, which is accessible from StudentHome.

The key principle is to adjust the workstation to your needs, not for you to adjust to your workstation. If you use a computer at your place of work, your employer should have a formal procedure for assessing your computer workstation that you should use. If you are using a computer at home, you should still take sensible precautions to ensure that you use it safely.

You should avoid sitting at your computer for long periods of time without a break.

When using your computer to access internet resources, you should minimise the risk of your system becoming infected by viruses and other attacks. Information on how to minimise the risk of attacks and how to improve your computer's security can be found in the Computing Guide.

2.2 Minitab, the statistical software package

M140 uses the statistical software package, Minitab, to carry out some statistical computations and produce statistical graphics, to demonstrate some statistical ideas and examples, and to give you some experience of using standard statistical software. (Minitab is used extensively in universities for teaching, but is also used quite widely in some industries as a statistical analysis tool.)

General instructions for installing Minitab, and data files that will be used with Minitab for M140, can be found on the M140 website. The M140 Computer Book will guide you through activities in which you will use Minitab to carry out calculations and data analyses, and to produce graphics. The units will tell you when to work through specific chapters of the M140 Computer Book, and those chapters will tell you when and how to use Minitab or interactive computer resources (as described in Subsection 2.3).

Minitab requires the Microsoft Windows computer operating system (Windows XP, Vista, 7 or 8) to run. If you are confident, it may be possible to run Minitab on a computer with a different operating system, for example an Apple Macintosh, but only by running Windows on it using Boot Camp or a similar dual-boot system.

2.3 Interactive computer resources

The M140 Computer Book uses online demonstrations of some statistical concepts and examples, which are designed to reinforce ideas covered in the units. The Computer Book will direct you to the appropriate interactive resources. Specific instructions for using them will be displayed on screen. The interactive computer resources can be accessed from the M140 website.

2.4 Screencasts

Screencasts are short audio-visual presentations in which a member of the module team explains a statistical topic or example. You will need to have speakers or headphones connected to your computer to hear the audio of the screencasts. You will be guided to the relevant screencasts on the M140 website as you work through the module material.

2.5 Practice quizzes, iCMAs and iCME

The practice quizzes, the iCMAs and the final iCME are provided on the M140 website. (The final iCME works just like the iCMAs except that your score will not be given until later.) You need to be online while you are working on these, but you can take breaks whenever you like. Your answer to a question will be automatically saved whenever you move on to another question. While you are doing a practice quiz or iCMA you are advised *not* to use the Back or Forward buttons of your web browser but to use the controls within the quiz.

You should read the instructions at the start of each iCMA. The answers to the questions can be entered into your computer in a straightforward way, for example by typing or by selecting one of the offered options, depending on the particular question being answered.

More detail of exactly how to use the practice quizzes and iCMAs is given in the section on iCMAs in the OU Computing Guide, which is accessible from StudentHome. To make sense of that section, you need to know that M140 uses the 'iCMA interface' to the OU assessment system, and that:

- The M140 practice quizzes can be thought of as just another kind of iCMA, except that they use 'instant feedback'.
- The M140 iCMAs are for assessment and use 'deferred feedback'. This means that you submit all your answers at the end after you have completed all the questions in the iCMA.

The Computing Guide provides some examples of the kind of screens you will meet when using practice quizzes and iCMAs.

After entering your answer in a practice quiz question, press the 'Check' button to have the question marked. You are allowed three attempts at each question. If your initial attempt is incorrect, press the 'Try again' button to be able to have another try. You can move to the next question by clicking the 'Next' button underneath the question, or you can take questions out of order by clicking on a question number in the left-hand panel.

When you have completed all the questions, you will be taken to a screen summarising the questions that you have answered or not answered. This can also be accessed by clicking 'End test ...' below the question navigation panel. You then need to click 'Submit all and finish' to end the quiz. You can take a practice quiz as many times as you like, and will usually get a different set of questions each time.

The iCMAs are very similar to practice quizzes. However, since these are not marked until after the cut-off date, there is no 'Check' button and the question numbers in the left-hand panel are not highlighted to indicate correctness – the numbers of the questions that you have answered are simply 'greyed out'. When you have entered your answer to a question, simply move onto the next question using the 'Next' button below it, or select a question number from the left-hand panel. You can revisit any of these questions and change your answers up until you press 'Submit all and finish'.

Submitting your iCMAs

When you have **completed** the iCMA, remember to select the 'Submit all and finish' button at the bottom of the summary screen, as otherwise your mark will not be added to your assessment record for M140.

Check that you have completed all the questions that you want to before selecting 'Submit all and finish', since **once you have selected 'Submit all and finish' you will not be able to attempt any more questions.**

If you take a break during a practice quiz or iCMA, you will be able to resume where you left off, even if you log out of the system. Your answers to the questions that you have already completed will have been retained. When returning to a practice quiz or iCMA, click the button to continue last attempt, and then select the question that you were working on, or the next question that you wish to try.

2.6 Forums

The M140 forums are a part of the module website where you can read and contribute to discussions with other students and tutors. When you access a forum, you will see a list of discussions and the number of posts that have been added.

To read a discussion, click on the discussion title. You will then see all the posts for this discussion – that is, the initial message and any replies. You can reply to any of these posts, by clicking the 'Reply' button. You will then be presented with a form in which you can enter your message. Once you have completed your message, post it to the forum by clicking the appropriate button.

To begin a new topic of conversation, press the 'Start a new discussion' button. You will then be presented with a form to complete requiring a name for the discussion (the 'subject') and the text of your message.

You can, if you wish, choose to receive copies of all posts to the forum by email to your preferred OU email account. To opt into receiving these emails, click 'Subscribe' at the bottom of the main forum page. To opt out of receiving emails, click 'Unsubscribe', which will only be displayed if you have previously subscribed.

Further details are provided in the OU Computing Guide, under 'Forums'.

When using the online forums, please remember to follow the appropriate online etiquette, or *netiquette*, as outlined below. (There is further information on this topic in the OU Computing Guide.)

Netiquette

Netiquette is the unwritten rule book for good behaviour online. Although the principles are similar to those for face-to-face conversation, the limitations of a text-based medium mean that you have to learn some new techniques. Other people can't see the expression on your face or hear your voice, so it is what you write that sets the tone of the conversation. It is best to adhere to the following ground rules.

Thank, acknowledge and support people

People can't see you nod, smile or frown as you read their messages. If they get no acknowledgement, they may feel ignored and be discouraged from contributing further. Why not send a short reply to keep the conversation going? However, do bear in mind that in a large, busy forum, too many messages of this nature could become a nuisance.

Acknowledge before differing

Before you disagree with someone, try to summarise the other person's point in your own words. Then they will know that you are trying to understand them and will be more likely to take your view seriously. Otherwise, you risk talking *at* each other rather than *to* each other.

Make your perspective clear

Try to avoid speaking impersonally: 'This is the way it is ...', 'It is a fact that ...'. This will sound dogmatic and leaves no room for anyone else's perspective. Why not start with 'I think ...'? A common abbreviation is IMHO (in my humble opinion) – or even IMNSHO (in my not so humble opinion). If you are presenting someone else's views, say so, perhaps by a quote and acknowledgement.

Emotions

Emotions can be easily misunderstood when you can't see faces or body language. People may not realise that you are joking; irony and satire are easily missed. Smileys or emoticons such as :-) and :- (can be used to express your feelings (look at them sideways). Other possibilities are punctuation (?! # @ * !), < grin > or < g >, < joke >.

Be aware of your audience: people from widely differing cultures and backgrounds may read what you write online. What you find funny may be offensive to them.

DON'T WRITE IN CAPITALS – IT WILL COME OVER AS SHOUTING!

Flaming

If you read something that offends or upsets you, it is very tempting to dash off and submit a reply – but don't! Online discussion seems to be particularly prone to such 'flames', and things may escalate in a flaming spiral of angry messages. So if you feel your temperature rising, take a break or sleep on it before replying.

Additional advice

- Keep to the subject, and pick the right topic for your contribution.
- Before you write a message, take time to see what is being discussed, and how.
- Keep messages short.
- Write a good subject line (title) for your message – people often haven't time to read messages unless the subject line looks relevant.
- Keep to one subject (one topic of discussion) per message.
- When replying to a message, quote part of the earlier message only if you need to. Don't include everything, or messages get longer and longer.
- Don't post or discuss your assignment scores in the forums. It's fine to say generally that you are pleased or disappointed with your score, but, particularly if it's a high score, students who did worse than you may find it discouraging, or think you are boasting (even if you had no such intention), if you post the score.

2.7 Online tutorials

Your M140 tutor may provide online support instead of, or in addition to, face-to-face tutorials. These will take place in online 'rooms', as part of a system called 'OU Live'.

OU Live allows communication using audio and text messaging, and the use of a shared on-screen whiteboard.

Your tutor-group room can be accessed from the M140 website.

To use OU Live you will require the following.

- A computer connected to the internet. Although a broadband connection is best, the system should work satisfactorily with a dial-up connection.
- Headphones to listen to your tutor and other participants. Alternatively, speakers can be used, but they tend to lead to sound problems when used in conjunction with a microphone.
- A microphone to enable you to speak to your tutor and other participants. A combined headphone/microphone headset is recommended to avoid possible sound problems. Although less effective, it is possible to participate in a session without a microphone, by making your input solely using typed text.
- Although not essential, you may find a plug-in graphics tablet useful to enable you to easily write and draw on the whiteboard.

Further details of how to access the online rooms and configure your computer are given in the OU Computing Guide.

You should check that your computer is suitably configured and test the system several days before your first online session.

2.8 Computing support

If you need help with any aspect of using your computer to study, a good place to start is the OU Computing Guide, which is accessible from StudentHome.

If you get stuck, contact the OU Computing Helpdesk, which provides technical support for the M140 computer resources and other OU-provided IT services and applications, including online forums and tutorials, problems with usernames or passwords, and access to websites and other online facilities. This includes technical problems with installing Minitab or with using the interactive computer resources (or the M140 website generally).

Help with system or hardware queries (e.g. your internet connection, formatting hard drives and installing hardware or operating systems) is *not* provided.

Contacting the OU Computing Helpdesk

If you are able to, please first see if your query is covered within the Computing help section in the Help Centre on StudentHome.

When contacting the helpdesk it will help to resolve your query quickly if you can supply your student number (personal identifier) and module code (M140), together with details of the problem that you are experiencing, including the full text of any error messages and details of your computer operating system (i.e. Windows XP, Vista, Windows 8, etc.).

The current contact details and opening times of the Computing Helpdesk are available from the OU Computing Guide.

BOOK 1 Descriptive statistics

Unit 1 Looking for patterns

Unit 2 Prices

Unit 3 Earnings

BOOK 2 Regression and surveys

Unit 4 Surveys

Unit 5 Relationships

BOOK 3 Hypothesis testing

Unit 6 Truancy

Unit 7 Factors affecting reading

BOOK 4 Association and estimation

Unit 8 Teaching how to read

Unit 9 Comparing schools

BOOK 5 Experiments and clinical trials

Unit 10 Experiments

Unit 11 Testing new drugs

Unit 12 Review.

SUP 04254 4



Cover image: minxlj/www.flickr.com